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The Miami Conservancy Bulletin

APRIL, 1922

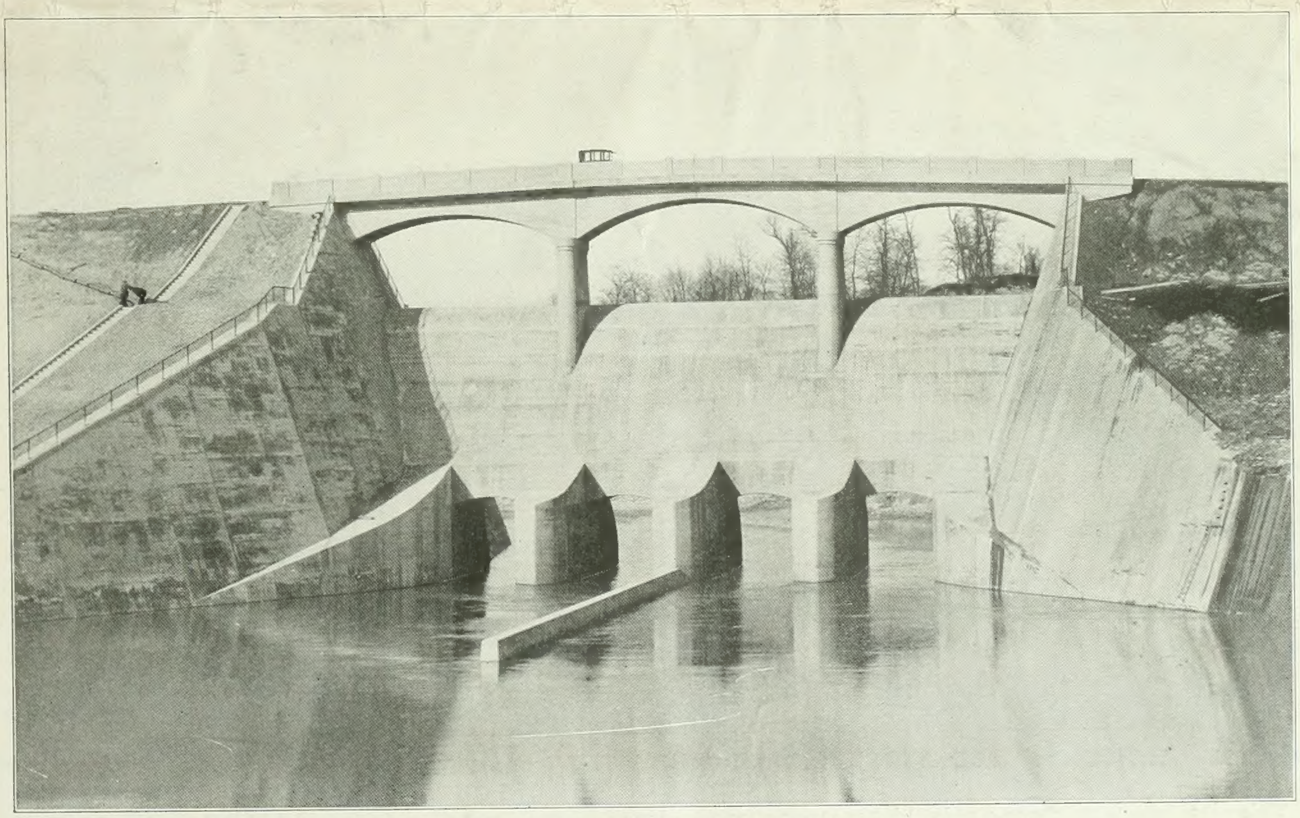

FIG. 346—TAYLORSVILLE OUTLET WORKS, MARCH 3, 1922.

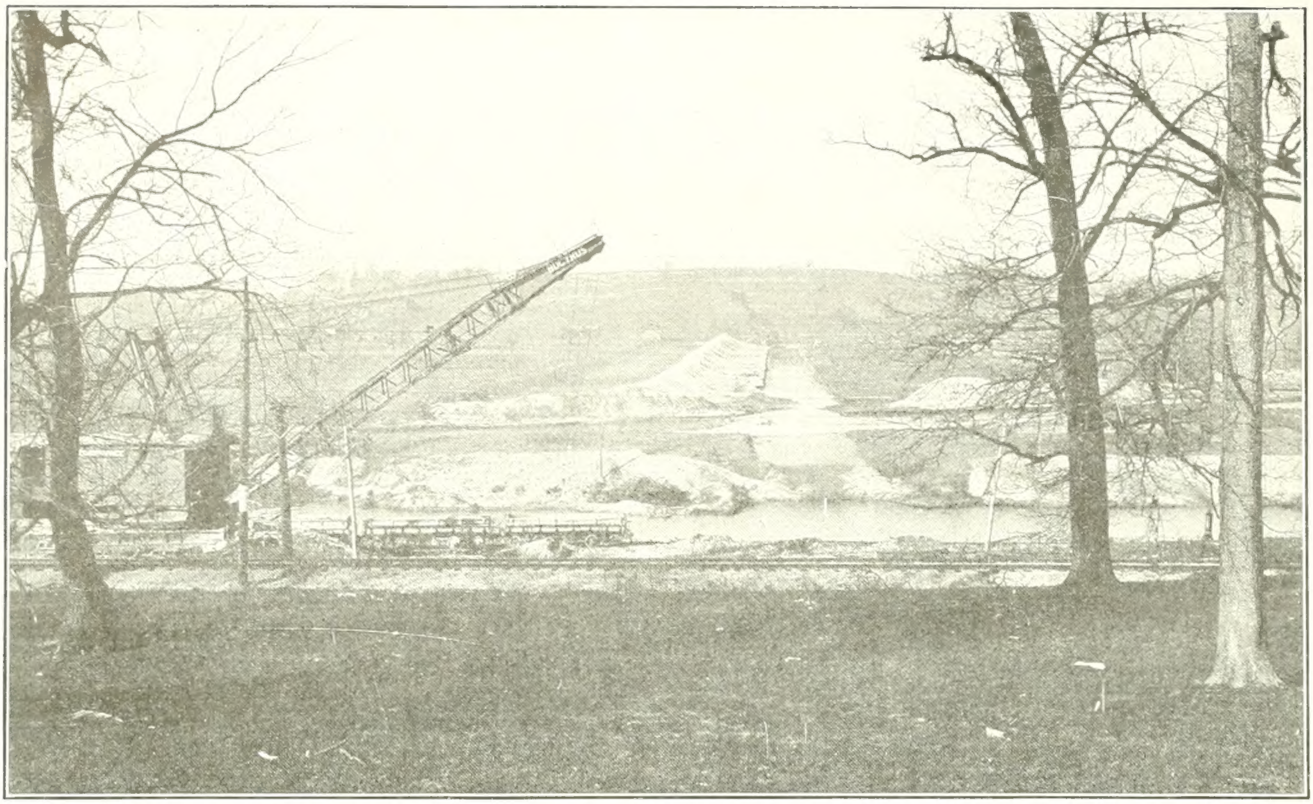

FIG. 347. LOOKING NORTHWESTERLY ALONG THE CENTER LINE OF THE HUFFMAN DAM SITE, DECEMBER 17, 1918.

The track in the foreground is the temporary line of the Ohio Electric; the temporary line of the Big Four is just below the hill. The water just over the hill is in the excavation for the outlet structure. The river channel can be seen just beyond. The ditch full of water running towards the distant hill is the cutoff trench along the center line of the dam.

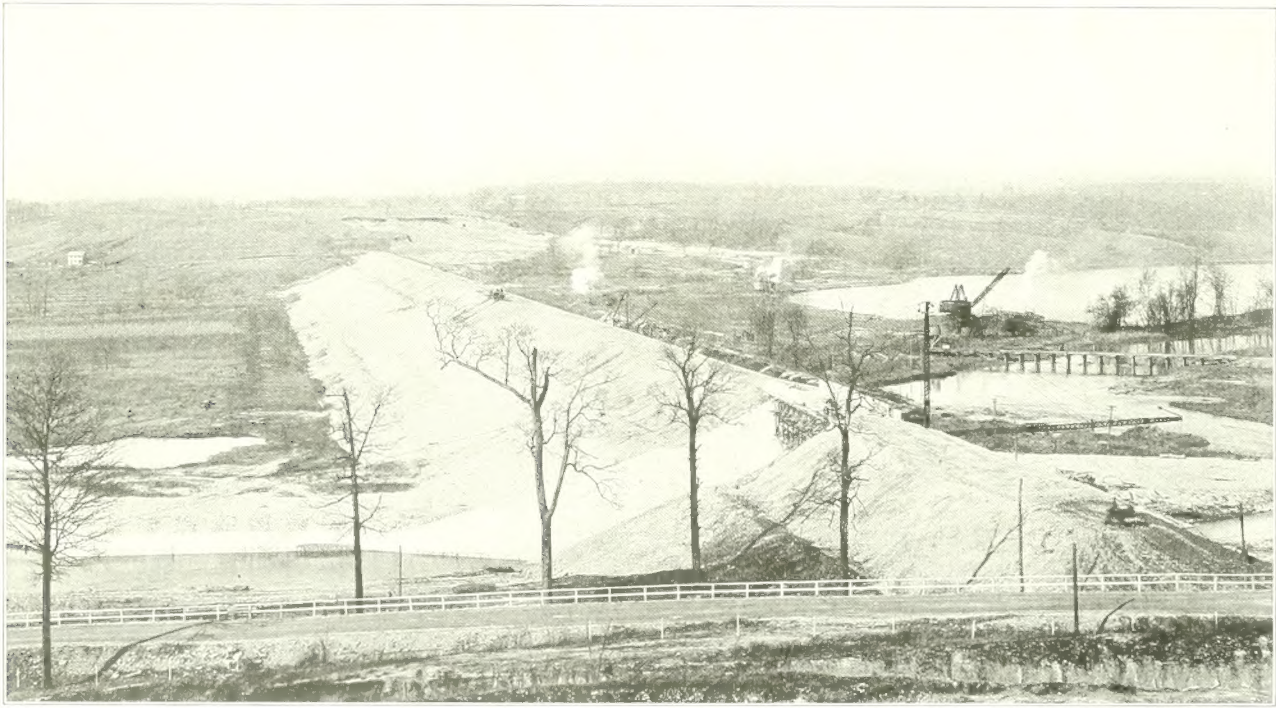

FIG. 348. THE COMPLETED HUFFMAN DAM ON JANUARY 6, 1922, LOOKING NORTHWESTERLY FROM THE EDGE OF THE BIG CUT.

This view was taken from a point higher up and farther downstream than the one from which the view just above was taken. The big cut is at the photographer's back. The cut at the lower edge carries the permanent location of the Ohio Electric. Then comes the relocated Springfield Pike, and then the part of the dam built by teams. The forms are still under the spillway bridge. The men on the hydraulic fill part of the dam are putting the finishing touches to the trimming. The river channel at the right has since been closed off, and a new one opened up.

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Death of Hon. John Galvin

On March 1, 1922, word was received from Cincinnati, of the death of Honorable John Galvin, age 59 years, former mayor of that city and member of the legal staff of The Miami Conservancy District. The news came as a great shock to his many friends in the Conservancy organization. The Bulletin extends sympathy to his family.

Soon after the Conservancy Law was passed, the Flood Prevention Committee made careful investigation as to a Cincinnati lawyer, and without his knowledge of such inquiry, and without any application on his part or on that of his friends, upon the recommendation of Judge Brown, John Galvin was unanimously chosen as local counsel for Hamilton County.

He came to Dayton at the time of the hearing, was in consultation before the hearing, and took an active part in all proceedings, from the hearing on the establishment of the District until after the appraisals were approved, and subsequently had acted as local counsel in all matters appertaining to Hamilton County. His ability and industry were shown during all these years, and his services were of great value to The Miami Conservancy District and the cause of flood prevention. The people of this valley can never repay their debt to Mr. Galvin for these services.

At the time of his death, Judge Brown, who was then at De Land, Florida, immediately telegraphed his sincere condolences to Miss Galvin, the only daughter, and to the firm of Galvin & Galvin, on the loss of father, brother and partner, stating that the City of Dayton, The Miami Conservancy District and the Miami Valley join Hamilton County and Cincinnati in honoring the memory of Honorable John Galvin, an able lawyer, a faithful officer and a true friend.

A Minor Flood in December

A storm of considerable intensity swept the Ohio Valley during the latter part of December, causing a river stage at Cincinnati unprecedented for December, and causing serious high water conditions at a number of places. The Miami Valley received much newspaper notice because it was not affected by the prevailing high water. The flood protection works received a good deal of undue credit in consequence. The basins all stored water, especially Germantown, where 31 feet was backed up by the dam, and Englewood where 23½ feet was held back. But the total amount stored was a very small proportion of the capacity of the system, and while the river stage at the towns was reduced somewhat by the improvements, the storm would not have produced a flood stage in the Miami Valley even under the old conditions. The principal reason for this was that the storm, very severe in the lower end of the valley, "feathered out" rapidly towards the north, so that a relatively small amount of rain fell on the upper end of the valley, where most of the flood runoff originates. But there was, however, at that time, a beautiful example, in miniature, of how the flood prevention works will prevent floods. A great many people motored out to see the basins, with water in them, and to see the hydraulic jumps work.

The Flood Prevention Work Honored

The Miami Valley and the Conservancy District will be honored by the meeting of the American Society of Civil Engineers in Dayton, early in April, to discuss "Flood Problems." The selection of the meeting place and the topic for discussion is indeed a compliment to the Flood Prevention work.

Huffman, Taylorsville and Englewood Dams Completed

Retarding Basins Now Function 100 Percent During High Water.

Just a few hours before the bells announced the birth of the New Year 1922, the last of the hydraulic fill was placed in the dams of the Miami Conservancy District. To many the end was unexpected. Even among the employees of the District, at the start of the construction season of 1921, the opinion was general that two seasons work would be necessary, to finish at Englewood, if not at Taylorsville and Huffman. The Bulletin had already covered most of the details of construction of Englewood, Taylorsville and Huffman, but little has been said about the final effort that was made to be ready for the flood season of 1922.

It will be remembered by the readers of the Bulletin, that Taylorsville was completely shut down for some five or six months, and seriously held back in placing the hydraulic fill previous to the complete shut down, by the failure of the B. & O. to be moved out of the way on time. When traffic on the railroad was finally shifted, on July 7, 1920, a portion of the best part of the construction season was gone. The conduits on which work had been going forward without interruption were finished in the fall. The dam fill across the river channel could not be made until the critical flood season of 1921 was over, so the remainder of 1920 was devoted to raising the valley section of the dam as high as possible.

The construction season of 1921 opened with about 35 feet yet to go before reaching the top on the valley section of the dam, with the entire river closure yet to be made, and with over one-half million cubic yards of embankment necessary to complete the dam. The topping off of the valley section offered no especial difficulty except that due to the long pipe lines necessary to reach the west of the dam. The river closure was ticklish. It had to be started in April, in order to get it done in time. April meant flood danger. To divert the river through the outlet structure, and to meet the flood hazard to some degree, a rock fill was pushed across the river above the dam, using narrow gauge trains to transport the heavy rock. This phase of the work was described in detail in the June and July 1921, issue of the Bulletin. The flood of 1913 had scooped a hole in the river bed, and it was filled with "soupy" mud. Cleaning this up was hard work, and extremely exasperating, but it was finally accomplished, and sheltered by the rock buttress above the dam, the closure progressed very rapidly. Handling the number of cubic yards necessary to finish the dam in 1921 was considerably more than could be expected from the single dredge pump installation in use up to that time, so a supplementary unit was placed in a new borrow pit on the east bank of the river below the dam. The following table shows what was accomplished on the embankment in 1921:

March	49,400 cubic yards
April	62,900 cubic yards
May	58,700 cubic yards
June	107,200 cubic yards
July	81,700 cubic yards
August	63,800 cubic yards
September	49,500 cubic yards
October	40,200 cubic yards
November 30th	22,600 cubic yards

The steady reduction in the cubic yards per month in the last few months is normal. As the fill neared the top, the narrow banks, and small amount of embankment placed with each pipe movement, progressively reduced the monthly total.

In addition to the rock fill on the upstream side, a similar fill was placed on the downstream side. This was finished in early summer. When the embankment of the dam had progressed far enough so that it was evident that it could be finished before the spring of 1922, work was started on the spillway and spillway bridge. The former was finished in September, the latter in November. "Cleaning up" was started early in the fall, so when the last fill was placed on November 30th but little work remained to be done. The camp is now being sold, house by house. The Taylorsville job is a thing of the past. The dams and appurtenant structures cost complete, $2,225,000.

Huffman's history is one of uniform progress made by steady plugging day after day. Like Taylorsville, Huffman was seriously delayed by the failure of the railroads to be moved out of the way on

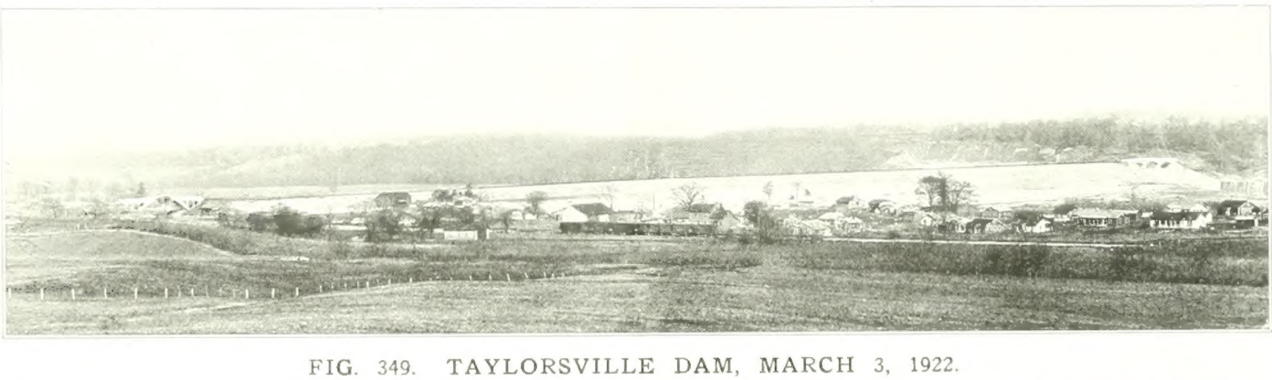

FIG. 349. TAYLORSVILLE DAM, MARCH 3, 1922.

View looking upstream. The dam is all complete, save for the guard rail along the road across the top of the embankment. The bridge at the left is the highway bridge carrying the National Road over the relocated B. and O. tracks. The bridge at the right is the spillway bridge shown on the frontispiece. The buildings in the foreground formed the construction village when work was in progress and are now being sold and removed.

FIG. 350. ENGLEWOOD DAM, LOOKING EAST ALONG THE DOWNSTREAM FACE. MARCH 16, 1922.
The spillway and bridge are in the foreground. A fill is yet to be made connecting it to the Covington Pike, shown in the left hand corner. The tracks of the Dayton, Covington and Piqua will be placed on a fill where the trestle is now, and will pass under the spillway bridge. The dam itself is all complete save for the guard rail along the road over the top. Considerable water was being stored in the basin when this picture was taken. The outlet from the conduits is behind the fill in the middle background, and at the extreme right of the picture. The fill is a part of a temporary spillway.

time. Even the conduits were delayed by delay in the temporary shift that removed the Big Four tracks from the site of the outlet works. The dam fill was started on time, and progressed favorably until the Erie tracks were nearly reached. Then it became evident that the railroad line was not going to be moved in time to permit uninterrupted progress on the embankment. A considerable part of the equipment was diverted to excavating and loading gravel for ballasting the new railroad tracks, and material was placed in the embankment only in between gravel loading times. Even then the dam progressed more rapidly than the railroad work. A low cross dam was built along the Erie tracks, that permitted the work to go forward a little bit, but it was not considered safe to raise the fill much higher than the railroad tracks. Even after the railroad traffic was diverted to the new line on October 4, 1920, the railroad authorities insisted on holding the old line open for a few days to guard against possible interruptions in service on the new line, so that it was the last part of October, 1920 before dirt really began to move as it should. The following is the yardage record from then on to the end:

October 1920	46,700 cubic yards
November	58,300 cubic yards
December	58,800 cubic yards
January 1921	64,400 cubic yards
February	23,600 cubic yards
March	81,200 cubic yards
April	91,600 cubic yards
May	97,400 cubic yards
June	88,100 cubic yards
July	64,200 cubic yards
August	75,800 cubic yards
September	59,600 cubic yards
October	55,600 cubic yards
November	55,600 cubic yards
December 6th	8,000 cubic yards

This steady progress is all the more remarkable when it is considered that but one dragline was used in the pit to supply the single dredge pump, and accidents (which seldom happened at Huffman) shut down the entire works. To call attention to this uniform and uneventful progress is to render the best of compliments to Huffman as it indicates careful planning, anticipation of difficulties, and alertness to prevent accidents and delays, as well as lots of hard, conscientious, work.

A special feature at Huffman was a borrow pit on the hillside at the north end of the dam. This was originally used to supply additional core material, as the regular borrow pits did not supply enough. The surface loam was stripped off by the hydraulic giant, and sluiced by gravity to the dam. Later, when the dam got so high that there was not enough grade for a gravity sluice, a pump was placed in service, and then some "heavys" were also put into the dam from this pit, as well as core material. This particular phase of the work was described in the August, 1920, Bulletin.

As at Taylorsville, the spillway weir and bridge was started when the "topping off" of the dam was in sight, and the last of the bridge was poured in December. At Huffman, some work on the river channel above the dam had to go over until the dam was finished and this work has occupied a small force through the winter. As far as flood protection goes, the dam was done in December. The cost, complete, will be about $1,900,000.

One million cubic yards a season, with a double outfit of pumps, and an excavation outfit big enough to keep the two pumps busy, was thought to be the limit of yardage that could be expected at Englewood. One million yards each in 1919, 1920, and 1921, would leave 600,000 cubic yards for 1922, which was considered enough for the topping off year. Englewood did not have any railroads in the way to hold things up. Annoyances enough were present, but the Conservancy was not forced to depend upon anyone else to do a part as it was at Huffman and Taylorsville on the railroad work, in order to prevent delay.

This is what Englewood really did. The first year, (1918) was devoted to conduit building, and to preparatory work, which was as per schedule. A little over one million yards went into the dam in 1919, which was also as per schedule. The next year (the "closure" year), one million, three hundred thousand yards were placed, which was beating the schedule with a vengeance. Another one million, three hundred thousand cubic yards was the score in 1921, and the dam was finished on the last day of the year. The following table shows the monthly record for 1921:

March 1921	115,400 cubic yards
April	145,100 cubic yards
May	137,100 cubic yards
June	180,600 cubic yards
July	157,600 cubic yards
August	163,500 cubic yards
September	143,000 cubic yards
October	128,800 cubic yards
November	57,200 cubic yards
December	75,600 cubic yards

Towards the end, the fates seemed determined to prevent completion in 1921. The washout on the night of October 25th was described in the November, 1921 Bulletin. The loss of even the few days involved was serious. Then heavy rains came in December. The tunnels which carry the normal flow of the river, had been built double size to carry flood flows during construction. Due to the uncertainty about Englewood getting done in 1921, reducing these to their normal size was delayed until late in the season, when the end was apparently in sight. The first of the twin tunnels was filled in and floored without difficulty, but it was a different story with the second. The work was flooded out so many times that it seemed that preparations to work on it was the signal for the weather man to send more rain. Finally it was finished in between rains, but just in the nick of time, for the high water of December came almost before the concrete was set, and put twenty feet of water in Englewood Basin. Other perverse things happened on the hydraulic fill. One of the small draglines, used in topping off operations, had needed an overhauling for some time, but work on it was being postponed until the fill was finished. This dragline broke down at an inopportune moment. Even in the last hour of the last day, the pipe line plugged and only by the hardest kind of work was the line cleared, and the last few yards placed before the new year came.

The spillway is a separate structure at the west end of the dam. As flood control during construction was not dependent upon it, it was built during the summer of 1921, quite a while before the fill reached the elevation of the spillway. As all the equipment available was being used to rush the dam work, the approaches to the road across the spillway bridge, and the shift of the D. C. and P. Traction to a location under the bridge, was not made in 1921, but will be completed in the spring of 1922. Quite a few finishing off jobs will be also done then. The force required will be small and a camp will not be needed. It is planned to sell the village at auction on March 29th. Englewood Dam will cost complete with all appurtenant structures, $3,500,000.

The Design of the Spillway Bridges

Limitations Imposed by Situations of the Structures Cause Development of Unusual Types

Highways cross the valleys on the tops of all five of the dams of the Miami Conservancy District. The concrete bridges which span the spillways of the dams are designed for modern automobile trucks. A number of unusual features are included in the design and construction of these structures.

The present state law (the so-called "Burke Law") places a maximum of ten tons for the gross weight of vehicle and load that may be moved over the highways of Ohio. Motor traffic, in both number and size of machines, will no doubt greatly increase in the next few years, and force a revision upward of the allowable weight. But there is a definite limit to the increase in weight. This limit is imposed in part by practical operation costs and in part by the thousands of bridges, and the many miles of paved highways that have been constructed at heavy expense, and will not stand traffic beyond this point. Therefore, after careful consideration, two twenty-ton trucks travelling in the same direction and passing over the bridge side by side was selected as the maximum "live" load for the design. The load on the rear axle of each was taken as 14 tons, and on the front axle as 6 tons. The twenty ton truck is probably heavier than the physical limit, mentioned above, imposed by the present highways and bridges. Even if a bigger truck should develop, it would be improbable that two big ones would try to pass over a bridge at once. Besides the "live" load, the bridges are designed for the dead weight of the bridges themselves, and an impact or blow equal to 30 per-cent of the live load. Under the maximum loading

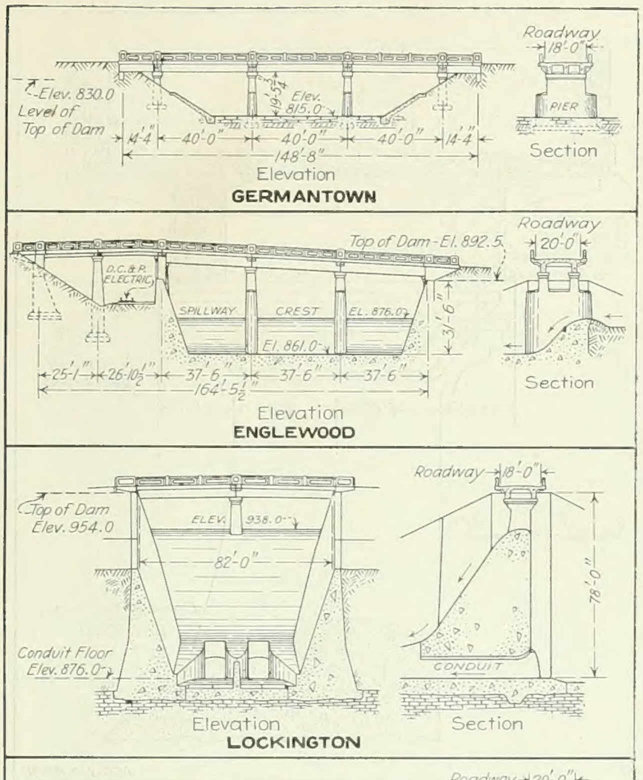

FIG. 351. COMPARISON OF THE FIVE SPILLWAY BRIDGES.

of live load, dead load, and the impact, the concrete is stressed to five hundred pounds, and the steel to fourteen thousand pounds per square inch, which stresses are about one quarter of that which would be required to break the materials. The assumptions about shear will be discussed later in this article.

The situation of the bridges imposed certain limitations on the types of structures selected. The abutments for three of them, Lockington, Taylorsville, and Huffman, are the high side walls of the outlet structures, while the abutments for the bridge at Englewood are the spillway walls of less height, but high enough to be a special problem in themselves. The Germantown bridge is situated unlike any of the other four. See figure 351. The requirements of flood protection imposed other limitations. The spillways are designed for a maximum water depth varying from 10 feet to 14 feet at the different dams. Three feet was decided upon as the minimum distance between the maximum water surface and the bottom of the bridges. Types of structures giving long clear openings to prevent possible clogging by drift, and to permit as large a discharge as possible, were also desirable. Permanence, safety, good appearance, and economy in cost were also necessary features.

Steel truss bridges were planned originally, and the walls that would later be their abutments were designed and built for that type of bridge. A change was made later to concrete as the bridge material to be used, because it is more permanent, and makes a better appearance. Studies were made of many different designs for concrete bridges, and cost compared, before the final designs were selected. Arch bridges were first considered for meeting the conditions. An arch pushes outward on its abutments (see figure 352). The walls of the outlet structures

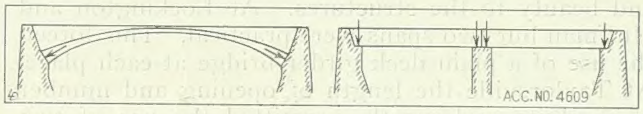

FIG. 352. REACTIONS OF THE ARCH AND GIRDER.

are not heavy enough to stand this outward thrust. To have made them strong enough would have so added to their size that the extra cost was prohibitive. This was even true at Englewood where the walls of the spillway are much lower than the walls of the outlet structures at Lockington, Huffman, and Taylorsville. A bridge whose reactions are shown in the second part of figure 352, that is, that bear straight downwards on the abutments, instead of tending to push them over, is the type best fitted for the conditions. This narrows the field down to the girder bridges, although some thought was given to a concrete bowstring arch. This latter type of structure, while meeting most of the conditions nicely, was prohibitive in cost.

Of the girder types, the most desirable would be a single span, reaching from wall to wall, and without piers in the waterway. However, the dead weight of the girders would have been so great, due to their great length, (80 to 144 feet), that a departure from conservative designs would have been necessary, and a field entered that is not covered by experimental data or practical experience. Such a departure from accepted engineering practice was not thought advisable in such vital structures as these. Therefore, the use of piers, placed on top of the spillway weirs, and spaced far enough apart to give a wide clear waterway, was decided upon (see figure 351) thus reducing the length of girders to within the sixty foot mark. The types of girder

bridges considered were the through girder, and the deck girder. In the former, the floor hangs between the girders, the girders themselves being the railings. In the latter, the floor rests upon the girders, placing the vital part of the structure out of the way. Heavy motor vehicles have been known to wreck through girder bridges by running into one of the girders. In addition, the cost of the deck girder bridges is less, their appearance is superior, and certain advantages are secured in the design of the piers. All these advantages led to the selection of the deck girder type in preference to the through girder type.

Due to an optical illusion, a bridge built on a straight line looks as though it sags in the middle. Therefore all of the bridges, save at Englewood, where there are special conditions, are built on vertical parabolic curves. Not only is the entire bridge higher in the middle than at the ends, but each girder has a slight camber, or arching effect of about one inch, to cover possible slight deflection or sag. Then each bridge floor is higher than the grade of the roadway on each side. This is both for the purpose of supplying waterway underneath, and satisfying the instinctive desire in the average person, to have something to go up over, when crossing a bridge. Elaborate features that would run up the cost were not added, but every effort was made to give grace and beauty to the structures. At Lockington and Huffman but two spans were practical. This forced the use of a plain deck girder bridge at each place. At Taylorsville the length of opening and number of conduits underneath, permitted the use of two piers for the bridge. The simple girders on the two end spans were cantilevered out to form the center span. The graceful curve of the lower edge of the girder is an advantage inherent to the cantilever girder, (See Fig. 346), and is a result of the selection of the most economical proportions. By comparing this type with the others. its good lines are apparent. Germantown is a simple deck girder bridge. Its location, down in a hollow, did not call for special treatment.

The most suitable foundation for the Englewood spillway was a rocky ridge at the west end of the

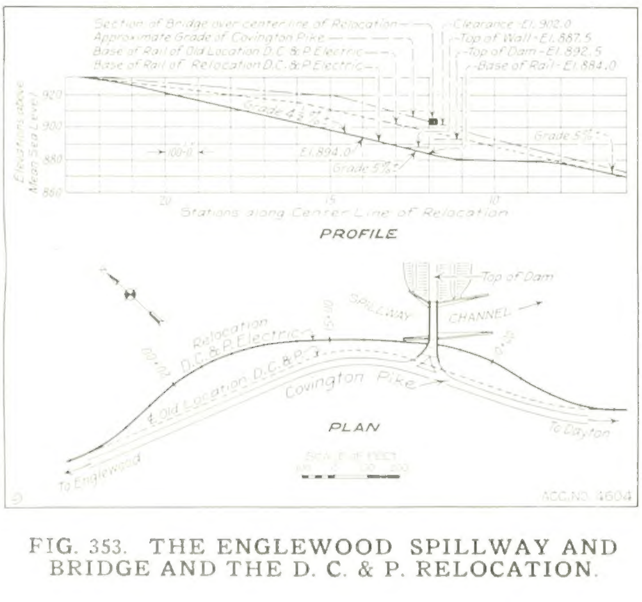

FIG. 353. THE ENGLEWOOD SPILLWAY AND BRIDGE AND THE D. C. & P. RELOCATION.

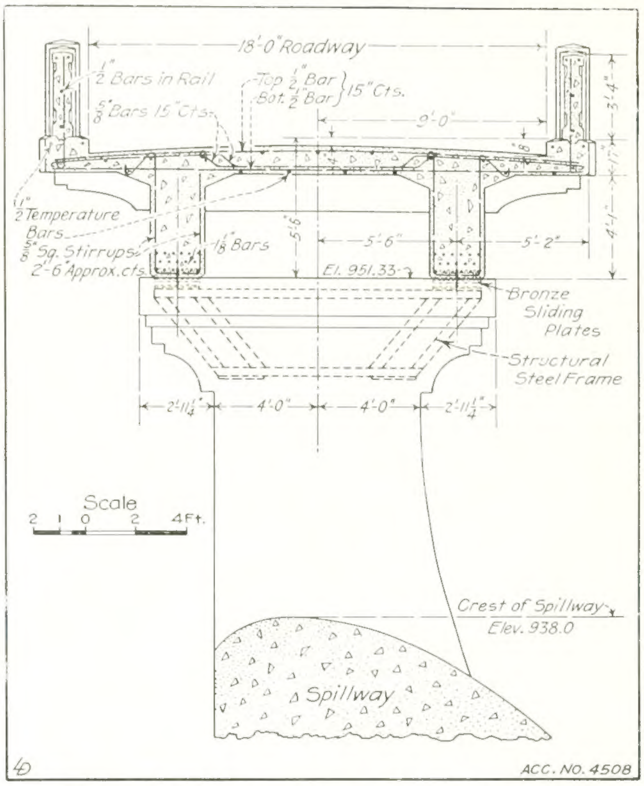

Fig. 354. CROSS SECTION OF THE LOCKINGTON SPILLWAY BRIDGE.

dam, close to the Dayton, Covington, and Piqua Traction, and the Covington Pike. By relocating about 1800 feet of the traction line and running it through a supplementary opening just west of the main structure, a grade crossing at the end of the spillway bridge was eliminated. The elevation of the highway above the top of the dam, and the necessity for clearance over the track resulted in the bridge being built on a 5 percent grade, instead of the usual parabolic curve. The closeness of the structure to the road, and the grades, necessitated a flared out floor on the west end to make a good connection with the pike. Figs. 353 and 350 show conditions. Because of the unequal length of the spans, the shallow beams over the traction and the odd shaped floor, it was impractical to use anything but the deck girder type of bridge.

The spillway at Germantown is in a rocky saddle in the hills, some distance from the dam. A notch has been cut in the rock to the required depth, and some concrete collars placed across the notch, making a very simple structure. The bridge spanning it was not limited in any way as to length, nor in length of peir. Two piers were used, and three parallel girders with a concrete deck comprise each span (See Fig. 351). The use of three girders is the common practice in such bridges. The Germantown structure was designed and built before work was started on the other four.

A different situation existed at the other four dams, especially at Lockington, Taylorsville, and Huffman where the ogee spillway weir is of considerable height. After the Germantown bridge was built, the Lockington structure was considered. As mentioned above, the original intention was to

use steel trusses to span the spillways, and the notches cast in the side walls of the outlet structure to receive the Lockington spillway weir were set well downstream. By the time the construction of the earth embankment had reached the stage where the spillway weir could be placed, a concrete bridge

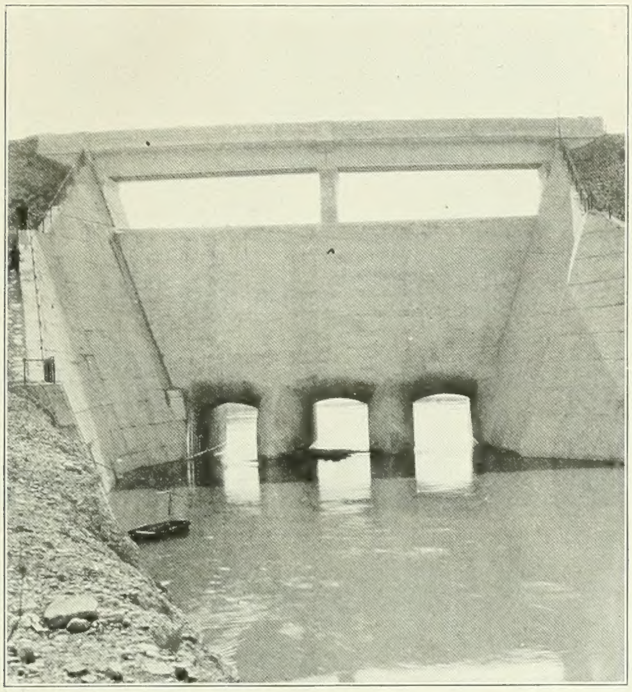

FIG. 355. HUFFMAN SPILLWAY AND BRIDGE, MARCH 22, 1922.

The view is from the basin side looking directly downstream. The long beak on the piers extending upstream is for the purpose of breaking up ice and debris. The expansion joint in the bridge can be seen just over the pier.

had been decided upon. Even by setting the weir upstream as far as the notches permitted, a pier placed on top, could be but eight feet long. A longer pier could not be secured without shifting the centerline of the bridge downstream from the centerline of the dam, which was undesirable. It was then decided to bracket out the top of the eight foot pier by the use of cantilever projections, but even then the top of the pier was quite short. To meet this unusual condition, a two girder bridge with a cantilever deck was developed that proved to be so advantageous that similar ones were used at Taylorsville, Huffman, and Englewood, although at all three of these places piers long enough to have accomodated three girders could have been placed on top of the spillway weirs.

The advantages of the two girder type over the three girder type are quite interesting. Inspection of Fig. 354 will show that a shorter pier can be used under the two girders, with a consequent saving. Then, a pair of bronze expansion plates are saved, which is another economy. The form work for two girders is less than for three, as the framing for one girder is saved. It is an axiom of design that a floor carried on two supports is a simple structure, while one carried on three is a complex structure which cannot be accurately analyzed, and contains complex stresses. And last, but not least, the two girder bridge is not as likely to be overloaded as the three girder type. See Fig. 356. The sketches represent the rear wheels of the twenty ton trucks, but the weight on each wheel is taken as unity, in order to simplify the diagram. A and B show the "natural" passing of the two trucks on the two types of girder bridges. This natural passing shows no advantage in the two girder type. But there is another very probable loading that must be considered, and that is one truck passing over the bridge, close to the curb as shown in C and D. This places a live loading of 1.25 on the outside girder of the three girder bridge, which is 35 percent more than its loading from the "natural" passing of the trucks. This makes the total live loading to be designed for in all three girders, 4.65, against only 4 for the live loading in the two girders of the other type.

Now it is possible to raise the factor in the two girder type 7½ percent by having another truck of 20 tons pass the 20 ton truck running close to the rail, both trucks travelling in the same direction, as in E, or even raise it 15 percent by crowding the second truck over close to the first as in F. Such combinations of loads as E and F are conceivable, it is true, but will occur very infrequently, if at all. If they do occur the trucks will be moving so slowly that the impact would be so decreased that the bridge would not be overloaded. One other loading was considered—that of a single heavy piece of machinery. Such a load can be carried by the two girder type with one half the load on each girder, but it would be very hard to distribute such a load over three girders. A single load as high as forty tons can be moved over the two girder spillway bridges of the District, without overloading. It should be remembered that overloading, as used here, means a load in excess of that assumed in the design. If the bridges are overloaded they would

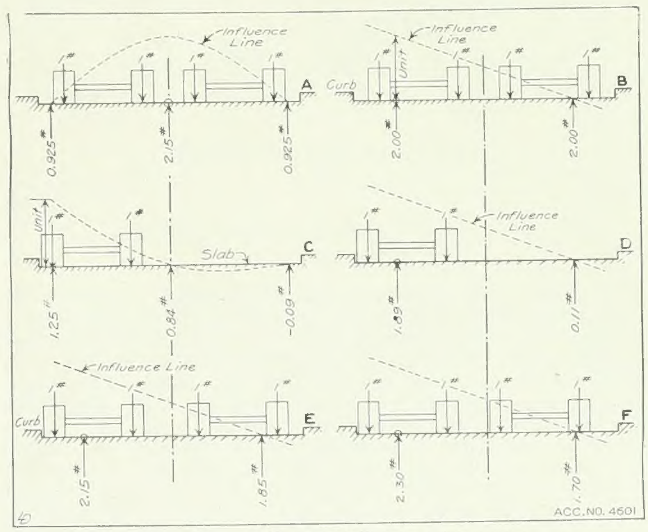

FIG. 356. LOADING DIAGRAMS.

not necessarily fall, for the maximum stresses assumed are only one quarter of those needed to break the materials. To use a much overworked and misunderstood term, the "factor of safety" is four.

Fig. 354 illustrates a typical girder as actually designed and built. It is shaped like a letter T. The load of the weight of the bridge, the passing truck, and the impact from the moving load, tends to bend the girder. This produces compression in the top of the girder, or the head of the T, which is resisted by the concrete itself, and produces tension in the bottom of the girder, which is resisted by the steel bars at the bottom of the stem of the T. The force which tends to bend the girder also tends to cause the particles of the concrete to slide upon each other, both in a vertical and horizontal direction. This latter tendency is called shear.

Readers will remember the theory of the lever,

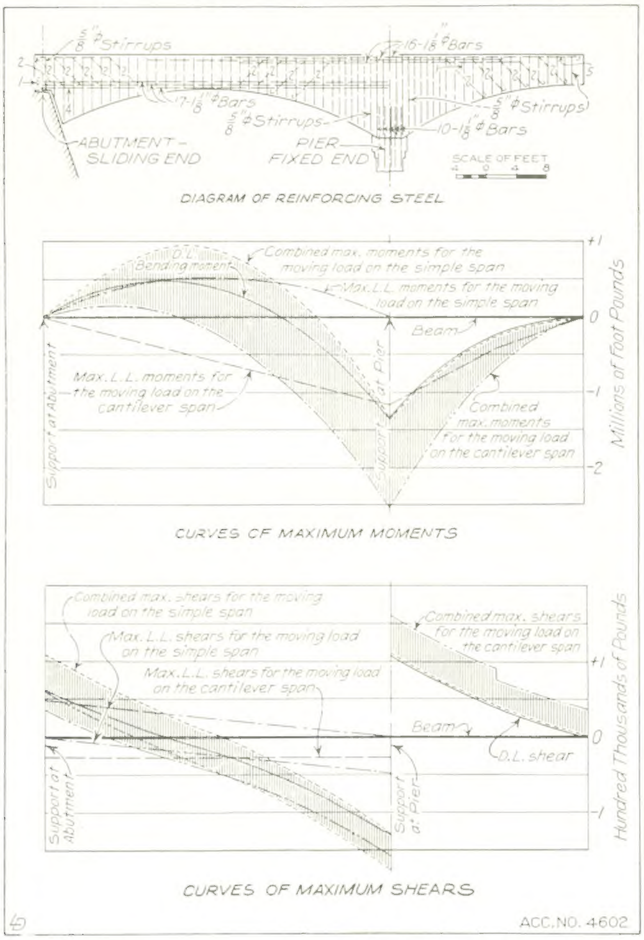

FIG 357. THE CANTILEVER GIRDER AT TAYLORSVILLE.

The lower diagrams were made by plotting the maximum bending moments and shears for each point on the girder, and drawing curves through them. The maximum moments and shears are produced by the dead load plus the live load in the worst position for the particular point being considered, plus the impact from the live load. Take away the live load and impact, and the moment and shear due to the dead load remains. The shaded areas represent the range in bending moments and shears between the dead load alone and the dead load plus the maximum live load and impact. The actual design is worked out from these diagrams, as explained in the text of the article. The influence of the diagrams on the location of the steel is especially well illustrated. It should be remembered that the design is a cut and try affair, and that a change in the dimensions of the bridge would change the dead load, and consequently the diagrams. The ones shown above are for the final design. Before they could be made, many preliminary diagrams were made and discarded.

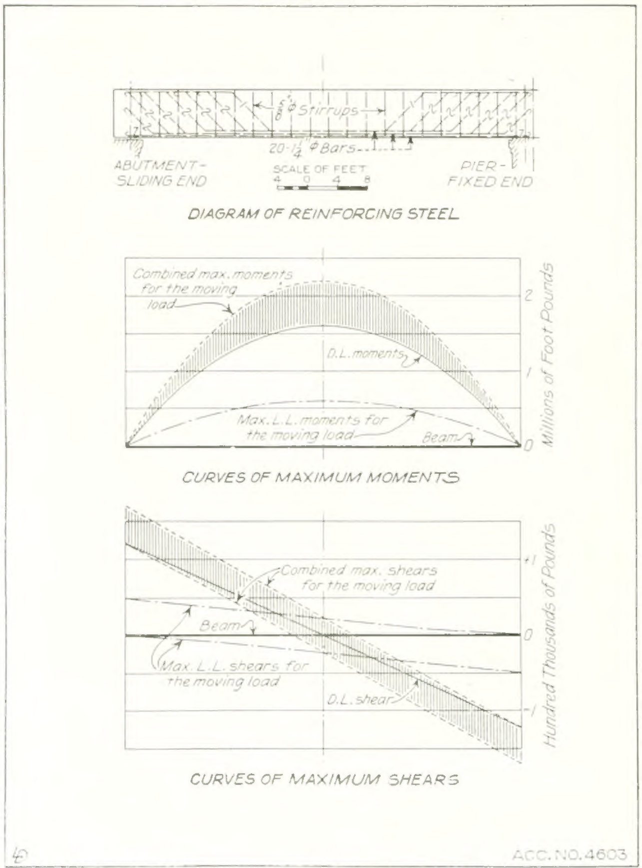

FIG. 358. THE SIMPLE GIRDER AT HUFFMAN.
While much simpler than Fig. 357, the arrangement is the same.

from their school day physics. The theory of bending moments, by which the girders of these bridges are designed is an advanced step of this old principle. In the cantilever girder, if a force (the load in this case) acts upon a body (the girder) having a fixed axis of rotation (the pier), it tends to produce rotation about this axis. It is this tendency to rotate (to deflect the girder) that must be successfully resisted, in order to have the bridge stand up. For a single force the numerical amount of this rotating tendency at any point is measured by the product of the force multiplied by the perpendicular distance from the given axis of rotation to the force. This product is called the static moment. For several forces, the measure of this rotating tendency is the algebraic sum of the moments of all the forces. In a simple girder, that is, one with two supports, the section to be considered is taken as the center of moments; i. e. the axis of rotation. The bending moment is the algebraic sum of all the forces, which includes both the loads and the reactions on either side of the section. In the cases of the Taylorsville bridge, where the simple girder has a cantilever projection, the two examples given above are combined. Figures 357 and 358 are actual diagrams of the maximum and minimum bending moments in the two types of girders used on the Conservancy bridges, at any point in the girder, for the moving load and impact, plus the dead load.

Take the bending moment at any section through the girder. Divide it by the distance between the

FIG. 359. BRIDGE FORMS AT LOCKINGTON, SEPTEMBER 2, 1921.

The bolts used to fasten the footing stringers to the curved face of the weirs are clearly shown. To further strengthen the footings a second row of bolts was placed lower down, and bracing put between.

tension area (the steel) and the center of the compression area (the head of the T, in this case of the T beam), and the force acting on the steel and concrete is secured. Again divide this first quotient by the area of the steel, and the result is the unit stress in the steel,—divide by the area of the compression section, and the result is the unit stress in the concrete of the compression area. The Conservancy bridges are so designed that, under maximum load the tension in the steel is 14,000 pounds per square inch, and the compression in the concrete is 500 pounds per square inch. It can readily be appreciated that the design is a cut and try affair, as the dead load is the weight of the girder and the bridge itself. This weight of course, varies with the size of the bridge. A change in the proportions of the structure changes the loading on the girder, and consequently the stresses acting upon it.

Besides being pictures of the maximum and minimum moments, the diagrams show other interesting things. Fig. 357, is for the cantilever bridge at Taylorsville. Where the curves are below the zero line, re-enforcing steel is needed in the top of the girder; where it is above the line, steel is needed in the bottom of the girder. The diagram, therefore, shows that steel is needed both in the top and bottom of the girder for a portion of the length of the span of the simple girder. It is not difficult, while looking at the diagram, to visualize the stresses, and the shape of the structure necessary to meet them. It is also evident that the curve where the simple girders join the side walls of the outlet works (the abutments of the bridge) is for appearance only, and is not necessarily an addition to the strength of the bridge. Fig. 358 is the diagram for maximum conditions for Huffman. These girders have a constant depth, and the area of steel required in the bottom of the girder is in direct proportion to the ordinates of the diagram.

The vertical shear at any cross section of a girder is the algebraic sum of all the loads and reactions on either side of the section. Figures 357 and 358 are shear curves for the Taylorsville and Huffman bridges, and give both maximum and minimum shears. If the total shear at any cross section is divided by the area of the average section, the average shear per unit of area is secured. If this average vertical shear exceeds 40 pounds per square inch, re-enforcing is added. Experience and experimental data show that beams or girders never fail because of their vertical shear, but rather the failure cracks are due to the resultant of a combination of the vertical shearing stress with the horizontal shear, acting in a diagonal direction. Therefore, when the re-enforcing is added. it is either vertical or diagonal steel or both.

The girders at Taylorsville are fixed at the piers. Expansion and contraction movement is provided for by sliding plates at the abutments and by the open joint at the center of the structure. The latter is plainly visible in the picture on the cover. The other bridges are provided with sliding plates at either piers or abutments.

The floor slab is similar in all of the bridges. As shown in Fig. 354 the floor slab and curb overhang the girders which support them. This gives a simple span between the girders and two cantilever projections or brackets on the outside. The cantilever projection and the simple span balance each other, and therefore, the slab of the simple span need not be as thick and strong as would be necessary if the cantilever projections were not used. The simple span is designed as if the rear wheels of the 20 ton truck were distributed over 5 feet 9 inches in length, of the floor. The overhanging cantilever part of the floor is designed as if the same load were distributed over 2 feet in length of the floor.

The series of sketches shown in Fig. 360 illustrate the various steps leading up to the construction of the bridges. When the spillway weir was cast, a notch or seat was left to receive the bridge piers. These notches had horizontal bearing faces; if stepping was necessary, it was done by vertical and

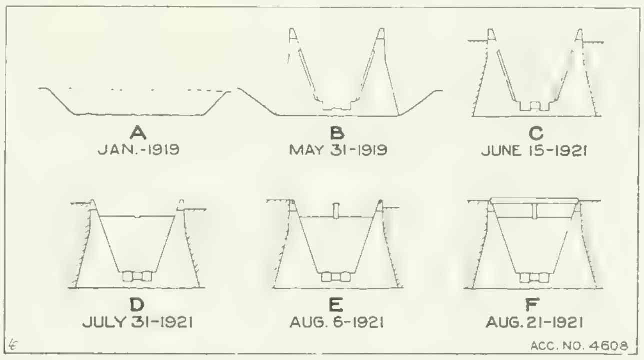

FIG. 360. THE SUCCESSIVE STEPS IN BUILDING THE LOCKINGTON OUTLET WORKS.

While the hydraulic fill was being placed the outlet was like a great trough through the dam, as shown by B, in order to take care of floods during the construction period.

horizontal steps. The forms for the entire structure were erected complete, except for the railings. The footings for the falsework were stringers fastened to the curved face of the weir by bolts previously cast in the weir. See Fig. 359. The concrete proportions were 1:2:4. The reinforcing was ovoid deformed bars, and was wired into position before concrete was poured. The gravel washing plants that were used in building the outlet structures were also used to prepare materials for the bridge work. The concrete was mixed and handled in bottom dump buckets. A steel derrick, mounted at Taylorsville and Huffman on one of the berms of the dam, and at Lockington and Englewood, on the floor of the spillway, picked up the buckets full of concrete, and hoisted them up to the bridge. Each span, including the curbs, was made in one continuous pour. The Germantown bridge, being quite a distance from the dam, used a small mixer at one end of the bridge. The forms remained under the bridges for about three weeks after pouring.

The roadways of the bridges will be paved with a bituminous macadam material. There is danger, if the concrete surface of the floor slab were used as a wearing surface, that the concrete might wear down so as to expose the reinforcing, before repairs were made. The bituminous surface is more likely to be kept in repair.

Progress on the Work from November 1, 1921, to March 20, 1922

GERMANTOWN

Completed.

ENGLEWOOD

The last yard of material was pumped into the dam December 31, 1921, completing the embankment of 3,612,505 cubic yards. There remains to be done the removal of pumping equipment and railroads from the upstream slope of the dam, the construction of a surface drainage system, the erection of guard rails and the grading of the roadway on top of the dam, the dressing and seeding of the slopes of the dam, and the placing of 6,000 cubic yards of rip rap as a protection against wave wash on the upstream face.

The concrete floor, reducing the outlet conduits to their permanent size, was completed December 16.

The spillway bridge was finished in November and there remains to complete the spillway proper, only one block of concrete in the floor and a small amount of grading.

Work is in progress looking to the shifting of the Dayton-Covington and Piqua Traction line to its new location under the spillway bridge for the purpose of obviating a grade crossing where the road on top of the dam joins the Covington Pike.

The abutments for the Prairie Ford bridge were completed late in December and work suspended for the winter. A contract for the removal from its present location to the new abutments of the steel highway bridge has been awarded to Connell & Rohrer of Dayton, Ohio. Guard rails have been set wherever necessary along Road No. 7. The grading and gravelling of this road is complete with the exception of a small stretch east of the Prairie Ford bridge.

The grading of the cut-off road between Roads 4 and 5 near the east end of the dam is in progress.

During the winter a small force has been engaged in repairs to draglines, locomotives and other items of plant.

H S. R. McCurdy, Division Engineer.

March 20, 1922.

LOCKINGTON

Completed except for placing part of the guard rail across the top of the dam.

TAYLORSVILLE

The Taylorsville Dam was rapidly nearing completion at the time of the last report in the November, 1921 Bulletin. The hydraulic fill was finished on November 30. The concrete slope paving, and the concrete spillway bridge, were completed soon after the first of December. All of the equipment has been dismantled, and transferred to other features or put up for sale.

A small force of men has worked through the winter in placing the metal guard rail around the outlet works, the wooden guard rail on the road at Dugans Bridge and along the road over the dam, and in dismantling the equipment. The roads built by the District have been placed in good condition, and will be turned over to the county in the near future. A house is being prepared for the caretaker.

As soon as the frost is out of the ground the planting of the slopes of the dam will be completed, and the concrete catch basin for taking care of surface water from the top and slopes of the dam, will be placed. This work will complete the finishing touches on the dams. About one third of the camp has already been sold and the remainder will be disposed of by the first of June. The buildings are being removed from the premises.

O. N. Floyd, Division Engineer.

March 20, 1922.

HUFFMAN

The last of the hydraulic fill material passed through the pumps on December 6. The small section of the embankment south of the outlet works, built by teams in thin layers, compacted by rolling, was completed January 7, 1922, with material hauled from the main borrow pits by train. A gap at an elevation above the spillway has been left to permit the passage of construction trains. It will be closed at the very last.

The spillway bridge was started October 17, the concrete was placed in the north span on November 10, and in the south span November 15th. The last of the railing was poured December 27.

After the completion of the dam embankment, 6300 cubic yards of material, under the gravel washing plant, and which partly blocked the entrance channel to the conduits, was removed, and then a new channel was excavated for Mad River, just above the dam. This new channel eliminates a bad bend in the river, and also removes it to a safe distance from the upstream toe of the dam. The suitable part of the 25,000 cubic yards excavated from this channel, is being used in placing a clay blanket in the old river channel. Four thousand cubic yards of clay material previously dumped from trains along the west bank of the old channel, is also being used in the blanket.

Rock paving has been placed on the upstream face of the dam, over its entire length from the bottom up to elevation 807.5. This is the height to which the water in the basin would reach if a repetition of the 1898 flood should occur. A strip on the upstream face, from 25 to 50 feet wide, and along the side of the north wall of the outlet works has been paved with heavy rock, and a similar strip is now being paved along the south wall. This should be completed soon after April 1st.

Rock slope gutters have been built at intervals of 450 feet on both sides of the dam from the toe to the bottom. Runoff water from rains will be carried to these gutters in drainage ditches along the top of the dam and on the berms and thence down the gutters, without erosion of the slopes.

During the winter the slopes of the dam have been trimmed, a guard rail built around the outlet works, the spoil levees along the toes of the dam leveled off, and much of the equipment dismantled. A part of the camp has been sold. But little work remains to finish up the job.

C. C. Chambers, Division Engineer.

March 20, 1922.

DAYTON

All levee embankment on the right bank of the Miami has been completed except for a section about 300 feet long between Cincinnati Street and the Big Four Railroad. The left bank from Bayard Street (below Washington Street) to the Big Four Railroad, a distance of about 2 miles, remains to be completed. Two Bucyrus, Class 175, draglines and one Lidgerwood, Class K, dragline are now engaged on this work. The hauling of 120,000 cubic yards of excavation from the river channel near Washington Street in standard

dump cars has been completed. The track has been taken up and the railroad equipment removed from the job.

Since the date of the last report 3000 cubic yards of concrete have been placed in manholes, sewer extensions and monolithic slope revetment. The total concrete yardage placed to date is 33,000 cubic yards, making this work about 90% complete. Price Brothers Company has completed the laying of blocks for flexible slab revetment on Wolf Creek and on the Miami River between the Dayton View and Third Street bridges and is now laying blocks along the First Baptist Church retaining wall.

The Sunrise Avenue gravel plant was dismantled in January, and the equipment sold. It turned out a total of 120,500 cubic yards of sand and gravel. A commercial plant, is now in operation on Wolf Creek, near Summit Street. This is privately owned and operated, but it is under the supervision of the District for the purpose of preventing the drifting of sand and gravel into the improved channel in Dayton. Similar plants will soon be in operation on Mad River near Webster Street, and near Findlay Street.

Dragline D16-15 was engaged from December 1 to December 9 in lowering a 24 inch water main at Miller's Ford for the city. Dragline D-16-16 was used three days in February on lowering the 18 inch St. Francis Street sanitary sewer.

Total channel excavation up to March 1 amounted to 1,408 000 cubic yards. Levee embankment amounted to 550,000 cubic yards. The total yardage handled in accomplishing these quantities has been 3,540,000 cubic yards.

C. A. Bock, Division Engineer.

March 20, 1922.

HAMILTON

The electric dragline D16-18, completed its work at the south end of the improvement, crossed the river removing the trestle at Station 110, and moved upstream along the east bank to the north side of the Main Street bridge. Excavation was started at this point on January 3, the material being hauled into the north spoil bank which is located east of the B. & O. and adjoining the Ford Plant. The total of item 9, channel excavation, to March 1st was 1,444,000 cubic yards.

A Class 14 Bucyrus dragline on rollers, which was brought to Hamilton from Franklin, started excavation on the Four Mile Creek cut-off channel in the latter part of January. This channel gives Four Mile Creek an improved junction with the river and requires 100,000 cubic yards of excavation.

The Class 14 Bucyrus caterpillar dragline, after completing the track work on the east side of the river, crossed the river north of Black Street and excavated the filling material for the Black Street bridge. This material was loaded on 4 cubic yard dump cars and hauled to the bridge by 16 ton dinkeys. This machine is now building the levee on the west side north of Black Street and finishing the channel slopes.

The Marion Model 21, dragline is grading and shifting track on the north spoil bank.

A concrete wall has been completed from the northeast corner of the Champion Coated Paper Mill along the west bank to Old Black Street. Work has been started on the concrete wall on east bank between Dayton Street and Market Street.

The Black Street bridge has been filled with gravel and opened to traffic. A 16 inch water main and an 8 inch gas main have been laid across the bridge. The lamp posts have been set. The construction of sidewalks and pavement remains to be done. The cableway and other equipment has been dismantled.

The tract of land east of the Miami River, west of the B. & O. and north of Old River has been cleared of timber.

Seeding has been started on the levees completed last year.

C. H. Eiffert, Division Engineer.

March 20, 1922.

PIQUA

Since the last Bulletin was issued the big dragline stopped building levee at Station 60, and shifted forward to Station 81; and began to build levee southward. This gap was left in order to allow time enough for the Kugleman property to be vacated, and to allow time enough for the plans for a new county bridge at Ash Street to mature. Just below Station 81 rock was encountered in the river bed. This necessitated the abandonment of the dragline work, and the machine is now moving back to complete the gap between Station 60 and 81.

The rock in the river bed has necessitated the purchase of borrow pits, and the building of the levee by teams or trucks. The levee below Station 88, as well as the Shawnee and West Side levees, will be let to contractors.

The grass planted on the completed portions of the levee last season is doing well, and little work will be necessary upon it, this year.

Albert Schroeder, Assistant Engineer.

March 20, 1922.

UPPER RIVER WORK

Troy.—The dragline, D-16-21, under the direction of Donald Jeffrey, completed the work covered by his contract on February 22, 1922, and it was then moved to the shop at Adams Street, where it is undergoing repairs. The work completed since our last report, consists of 9000 cubic yards of levee and channel work between Market Street and the B. & O.; about 9500 cubic yards of excavation below the B. & O.; the excavation of 4000 cubic yards from the channel below the Adams Street bridge; and considerable work near Adams Street for the gravel plant.

T. Daniels and Son completed their contract about December 15, 1921. Due to the wet weather, a part of their excavation at Adams Street had to be left until the coming season.

Price Brothers have nearly completed their work around piers "A, B and C" at Adams Street bridge. During their work at this bridge nine rises of the river have caused a total of 41 days delay outside of the extra work of cleaning up after each high water.

The work at Adams Street has progressed favorably during the winter months. Concreting only on good days, the north abutment and piers "E and F" have been completed, and pier "D" will be completed before April 1, as the footing has already been poured. The steel has also been placed on the east half of arch No. 7 and this will soon be poured. The work removing the fill on the old section of the bridge has been started. Part of this material will make the new south approach to the bridge and the balance will be hauled away.

Tippecanoe City—The dragline D-16-4 completed its part of the levee and road embankment at Tippecanoe on March 9, 1922. The total levee and road embankment made by the dragline amounts to 167,000 cubic yards. Approximately 10,000 cubic yards are yet to be placed by teams, as this material was so wet at the time the dragline was working that it would not stand in the levee.

The canal interceptor was completed by Glen M. Wiley on December 16, 1921, except for the outlet chamber near Plum Street, which the District delayed until the Fourth Street sewer had tapped the county sewers at Plum Street.

The work on the Fourth Street sewer progressed until by the last of January 1200 feet of 66 inch sewer had been built. During the last two months, the connections at Plum Street with the two 24 inch county sewers have been made, and several manholes built. At present work is in progress on the curved section of the sewer at the outlet into Bull Run Ditch. As soon as this work is completed, a start will be made on the 51 inch sewer between Plum and Main Streets.

Wm. Oberer has completed the two concrete culverts where Bull Run Ditch crosses under North Second and North Third Streets. The ditch is also completed between Second and Third Streets and the excavation for the ditch between Third Street and the B. & O. is nearly complete. The levee between Second and Third Streets is about one half done. As soon as Mercer completes the Fourth Street sewer outlet, Oberer will complete the sewer headwall and the revetment in the ditch at the sewer outlet.

A. F. Griffin, Assistant Engineer.

March 20, 1922.

LOWER RIVER WORK

Miamisburg—Since the last issue of the Bulletin in November, 1921, Price Brothers have completed the flood gate structures in the tail races of the Miamisburg Paper Company, the Ohio Paper Company, and Grove & Weber's mill. Only one of the five flood gate structures now remains to be finished, that is, the Miami & Erie canal job near the north corporation line. This is the largest of the five, comprising four 8 x 5 feet gates. Three of these gates are now in place and the concrete base for the fourth has been poured. Total concrete in flood gate structures placed to date is 925 cubic yards.

Franklin—The dragline work on the east side was completed December 14, 1921, and the machine was immediately dismantled and sent to Hamilton. Total yardage moved by this machine was about 100,000 cubic yards. The Miami Avenue wall was completed November 25, 1921, with the exception of 300 linear feet of concrete apron; the sheet piling for this has been driven and the concrete will be placed this season. Total concrete in the Miami Avenue wall is 2200 cubic yards exclusive of the apron. Five thousand cubic yards of fill was placed behind this wall adding 30 feet to the width of Miami Avenue for over a length of 500 feet. Various small jobs have been completed during the winter.

Middletown—Clearing of timber from the overflow areas through Middletown and above the Poastown Road bridge was commenced in February. There are 56 acres to be cleared. Three contracts were let and the work is now about 50% complete.

F. G. Blackwell, Assistant Engineer.

March 20, 1922.

RAILROAD RELOCATION

Big Four and Erie. Completed.

Baltimore and Ohio. Completed.

Ohio Electric. Completed. The work during the winter consisted of dismantling the old line.

Albert Larsen, Division Engineer.

March 20, 1922.

RIVER AND WEATHER CONDITIONS

November-December 1921. The total rainfall at Dayton for the months of November and December was 8.36 inches, which was 2.85 inches more than normal. On December 23, 2.07 inches of rain fell, causing a moderate rise in the rivers of the watershed and some impounding in the Germantown and Englewood retarding basins. Temperatures for these months were moderate, the highest 68 degrees, occurring on November 19, and the lowest 17 degrees on December 22. The mean temperature at the Dayton Weather Bureau for November was 44 degrees, and for December was 35 degrees. A maximum wind velocity of 48 miles per hour (for five minutes) occurred on November 18.

January 1-March 22, 1922. The total rainfall at Dayton for the period January 1 to March 22, 1922, was 6.66 inches, which is 1.55 inches less than normal. A rainfall of 1.85 inches (at Dayton) on March 14-15 caused a moderate rise in the rivers of the watershed and impounded water in the Englewood, Germantown and Lockington basins. The maximum stage at Dayton was 7 feet. Temperatures were moderate during the entire period, the lowest being 11 degrees on February 16, and the highest being 69 degrees on February 22. In general, the winter was mild with little snowfall.

C. S. Bennett, Assistant Engineer.

March 23, 1922.

The American Society of Civil Engineers to Hold Spring Meeting in Dayton

A meeting of the board of direction of the American Society of Civil Engineers will be held on Monday and Tuesday, April 3rd and 4th, at the Engineers Club in Dayton. This meeting will be followed by a meeting of the Society on the 5th, 6th, and 7th. While the annual conventions have been held during the summer months in different parts of the United States, this gathering will be the first technical meeting of the sort held outside of New York City. The selection of Dayton as the meeting place is in recognition of the Flood Prevention work, now rapidly drawing to a close.

On Wednesday, the 5th, the general topic "Flood Problems" will be discussed by the Society. The meeting will be opened by Chas. H. Paul, President of the Dayton Section. Mr. John R. Freeman, of New York, President of the Society, will preside After an address of welcome by Col. E. A. Deeds, formal papers will be presented as follows:

"Flood Conditions in Canada," by J. G. Sullivan, President Engineering Institute of Canada;

"The Relation of the Federal Government to National Flood Problems," by Major General Lansing H. Beach, Chief of Engineers, United States Army;

"Flood Problems in China," by John R. Freeman, President, American Society of Civil Engineers;

"Methods of Flood Prevention in the Mississippi Valley," by J. A. Ockerson, Past-President, American Society of Civil Engineers, Member, Mississippi River Commission;

"Relation of Flood Problems to Power and Irrigation Development in the Rocky Mountain States," by A. P. Davis, Past-President, American Society of Civil Engineers, Director, United States Reclamation Service.

"Flood Prevention Methods on the Pacific Slope," by C. E. Grunsky, Vice President, American Society of Civil Engineers.

"Standing Waves in Rivers," by N. C. Grover, Chief Hydraulic Engineer, United States Geological Survey, Washington, D. C.

"Flood Problems of the Miami Valley and Their Solution," by Arthur E. Morgan, Former Chief Engineer, Miami Conservancy District, and Chas. H. Paul, Chief Engineer, Miami Conservancy District.

The formal papers will be discussed by the members of the Society.

Thursday, April 6th, will be devoted to an excursion to Englewood and Huffman Dams, travelling by special traction cars, and to an inspection of the National Cash Register works, where the party will be entertained at luncheon. In the evening a dinner will be given at the Miami Hotel, at which Col. Deeds will be the principal speaker.

An inspection of McCook Field, a trip over the channel improvement work in Dayton, and a visit to Middletown as the guests of the American Rolling Mills, will occupy Friday. Noon lunch will be served at the Rolling Mill, to be followed by an inspection of the big plant.

Headquarters will be at the Engineers Club. A registration of those in attendance will take place on Wednesday. Special arrangements will be made for the accommodation of engineers who wish to see special features of the flood prevention works not covered by the excursions.

Further Reduction In Personnel

Since the last Bulletin, some additional men in charge of particular portions of the work have left. The list includes George L. Albert, hydraulic engineer, H. W. Horne, assistant division engineer at Englewood, Ivan E. Houk, assistant engineer, and Superintendents H. M. Sherwood, Albert Armstrong, and G. E. Warburton. Dr. W. M. Smalley now gives only part of his time to the District work.

Protection from a 1913 Flood a Year Ahead of Time

Schedule Set at Start of Construction Period Exceeded.

The dams of the Miami Conservancy District are like a chain—their full ability to handle floods is not developed unless all of the links are completed, and in perfect working order. The critical flood season in the Miami Valley is in the spring of the year, although serious floods may occur during any period of the year. As the last of the five dams was not due to be finished until mid-summer of 1922, the 1923 flood season was to have been the first one in which full protection was assured. Actually, all of the dams were finished by December 31, 1921, and were ready to do their full part in flood protection during the critical season this year, a year ahead of time.

When bids were asked for the construction of the various sections of the work, in the fall of 1917, the following schedule was set for the five dams:

	Date set for completion
Germantown	Sept. 1, 1921
Englewood	June 1, 1923
Lockington	June 1, 1921
Taylorsville	June 1, 1922
Huffman	June 1, 1922

Despite war conditions and many vexatious delays, Germantown Dam was finished on November 6, 1920, and everything moved out and the camp sold by January, 1921, almost a year in advance of the date set by the schedule. Lockington did not go so well, but the final clean-up was made there in October, 1921.

The annoying delays in getting the railroads out of the way had seriously held back both the Taylorsville and Huffman dams, so that they were actually behind schedule when the spring of 1921 came. Englewood had made good progress, far better, in fact, than had been anticipated. It was decided to use every effort to finish all three dams in 1921, and thus give the Miami Valley protection a year ahead of time.

The working season of 1921 was one of remarkable progress. Untoward things happened, of course, that generally cause trouble and delay, but nothing seemed to stop the work, and annoyances only caused the construction force to speed up to overcome them. By the end of the good weather season in the fall, the end was in sight. Taylorsville was finished first, on November 30th, then Huffman, on December 6th, and then Englewood, on December 31st. The river improvements are in such an advanced state that the towns are safe against the recurrence of a 1913 flood. Protection against the "40 percent greater" flood will be an accomplished fact by the fall of 1922.

FIG. 361. THE RISING FLOOD, NINE YEARS AGO.

Protection against what this picture shows, is the significance of the completion of the last dam of the Miami Conservancy District on December 31, 1921, a year ahead of time. Taken on March 25, 1913 at Fourth and Ludlow Streets, Dayton, the view shows well the first overwhelming rush of water. Before night the elevation of the water reached the globes on the lamp posts.

Progress on Sales

As anticipated, the sale of equipment and second hand supplies has become an important item in the business of the Conservancy District. Despite stagnant business conditions, the volume of articles disposed of, and the prices obtained, have so far been very gratifying.

Up to the 28th of March, the total sales had reached $576,500. Of this amount $385,500 represents the proceeds of salvaging the railroad lines, $107,000 represents the sale of equipment, repair parts, etc., and $84,000 represents the sale of supplies and material which is that class of stuff ranging between toothpicks and Ford cars.

The major articles of equipment sold so far include two standard gauge locomotives, three narrow gauge locomotives, forty narrow gauge cars, two class 36 Marion draglines, one class 24 Bucyrus dragline, one class K Lidgerwood dragline, four gravel plants, two derricks and a spreader car. More equipment is being released as the various jobs are finished and closed down. A good start has been made on the sale of equipment, but the greater part remains to be sold.

Salt shakers, cook aprons, houses, rat traps, second hand Fords, mop sticks, old lumber and dishes continue to be the principal stock in trade for the miscellaneous sales. The market for this kind of stuff has been largely local. The stock of articles resulting from the closing down of the first jobs is well disposed of, but as other jobs are being finished right along, the sales stock is continually being replenished. A number of houses have been recently vacated at Taylorsville, and they are up for sale now. The spring market in houses has been good, and no difficulty is anticipated in disposing of these. They are to be wrecked and removed from the premises.

On the 29th of March, the entire Englewood village, land and buildings was put up at auction. A large and interested crowd assembled in the mess hall. The high bidders were Wm. Reitz and Wm. Foster, of Dayton, whose bid was $27,000. The final sale is subject to the approval of the Conservancy Directors. If accepted, it will raise the total of the sales to date to $603,500.

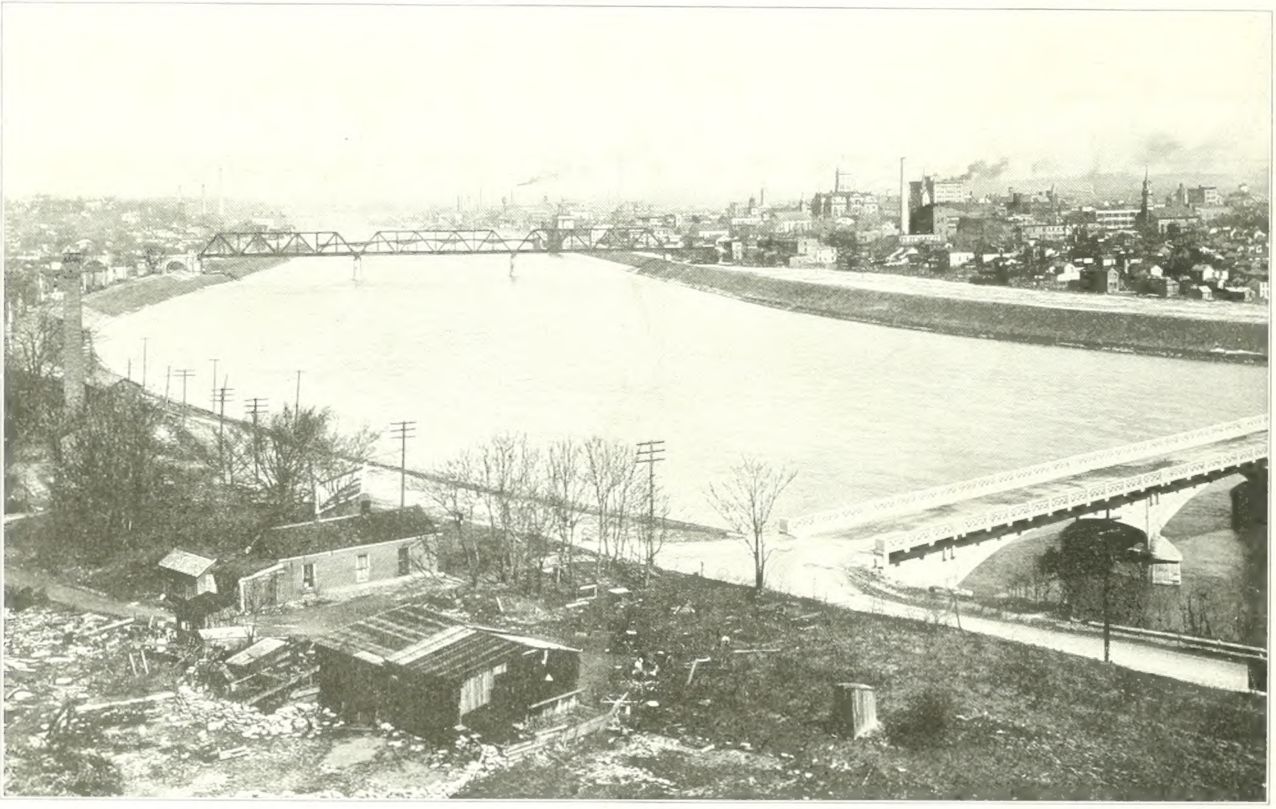

FIG. 362. THE HIGH WATER OF MARCH 15, 1922, AT HAMILTON.

A rainfall of two inches on March 14th, caused a storage of 36 feet in Germantown basin, 25 feet at Englewood, 15 feet at Lockington, 14 feet at Taylorsville, 11 feet at Huffman, and caused a 13 foot stage at Hamilton on the 15th. The operation of the improved channel is well illustrated. The view is looking upstream. The bridge in the lower right hand corner is the Columbia bridge. Then comes the steel railroad bridge, with the Main High Street bridge showing through the trusses. The new Black Street bridge can be dimly seen in the distance. The projection into the river between the Main High and Black Street structures is the river encroachment now being cleared away. Note the top of the concrete revetment just showing above the water.